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## **Video Conferencing Pilot Project**

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# Video Conferencing Pilot Project

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A pilot project was begun in mid-1990 that experimented with video teleconferencing among three high energy physics laboratories in the United States: Fermi Nat'l. Accelerator Laboratory, Lawrence Berkeley Laboratory, and Superconducting Supercollider Laboratory. The topology for the pilot system is configured as shown in Figure 1.

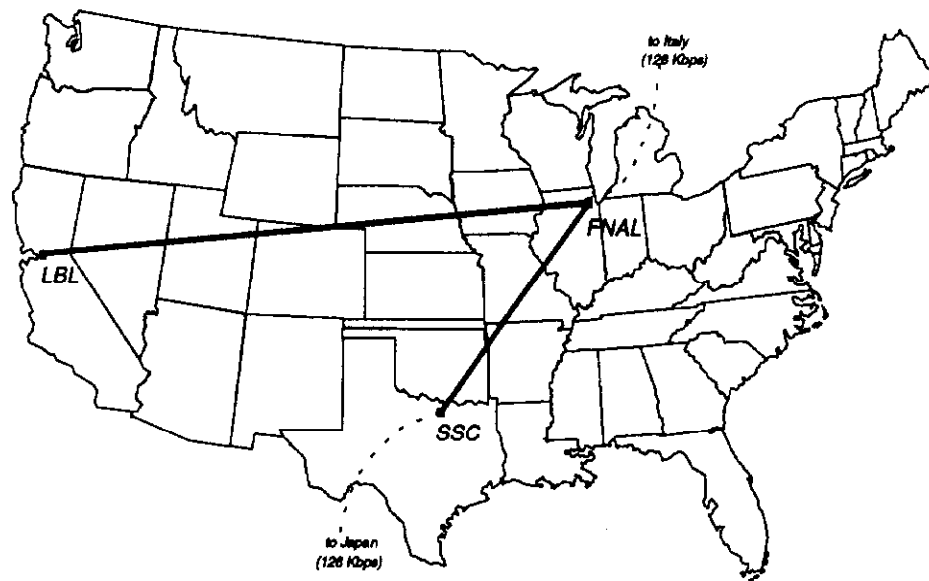


Figure 1: Pilot Project Topology

Figures 2 through 4 show the equipment configurations at the three sites as well as some proposed additions.

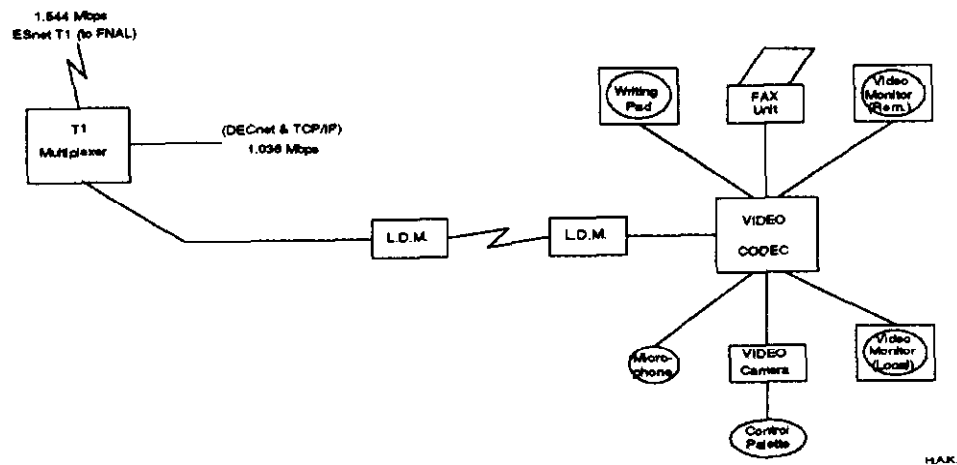


Figure 2: LBL Configuration

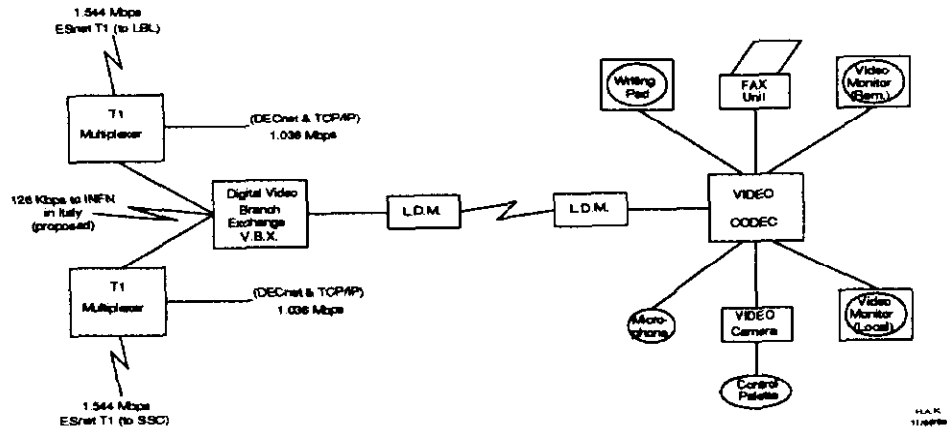


Figure 3: FNAL Configuration

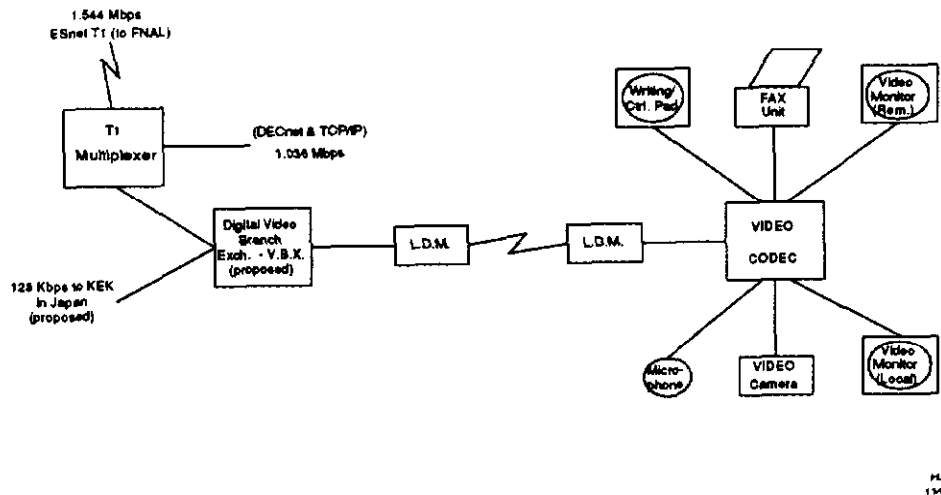


Figure 4: SSC Configuration

## Site Equipment and Nodes

The site equipment at the three sites is similar with minor differences in cameras, microphones, and the like. The codec vendor in all three cases is Video Telecom. Up to this point in the project a single video switch purchased by SSC from Video Telecom and placed at FNAL has been used. At this point that switch has been upgraded and moved to SSC and another switch has been acquired and installed at FNAL. The switches can handle pass-through allowing connectivity, for instance, from a site connected to FNAL to conference with a site connected to SSC.

## Links

The pilot project links have been provided by ESnet on a fractional T1 basis from the ESnet leased lines between FNAL/SSC and FNAL/LBL. 384 Kbps dedicated FT1 channels have been provided. Original conference testing and usage was done at the 384 Kbps rate. Recently, however, the rate was lowered to 128 Kbps. This reduced rate is in use today.

## Experiences

This pilot system was used by both experiment collaborations and also by the pilot project members. An assortment of difficulties arose with equipment, software, and site synchronization. Nevertheless, the system proved quite useful. One thing that became apparent was that an operator was needed in attendance at each site in order to make things work smoothly. This is consistent with experiences of other organizations.

When system link bit rates were reduced to 128Kbps, malfunctions resulted the most serious being conferences aborting in mid-meeting. Some of this was traced to "bugs" in a vendor's software. However, most of the difficulty was due to a high error rate line between FNAL and LBL. A new software release and improved line performance corrected almost all the problems.

With link bit rates of 128Kbps, there is significant lack of synchronization between video and voice that we cannot "tune out". Moreover, there is lag in the voice transmissions. This means that although the voice channels are full-duplex, they have to be dealt with as though they are half-duplex; much like one must do when speaking by telephone over a multiple hop satellite link. This proved generally unacceptable performance for true conferences. However, many conferences are really presentations. In these cases, the delay is acceptable. Investigations are underway to try to correct this.

## Observations

Both discussions with users of the pilot project and also knowledge of the results of conferencing studies led us to several conclusions. First, the most important component of video conferencing is *good* audio. Good, in this context, means low delay, low noise, full duplex, with quality high enough to make voices recognizable, and reliable enough to remain intact throughout the conference even if the video were to degrade or fail. Second was the ability to quickly (in at most seconds) convey image information both prepared and drawn in real time. Far down on the list was the need to look at each other.

Video conferencing is expensive. The cost of bit rate links of 100s of Kbps can range from \$1K to \$5K per month. The initial cost of site equipment and a specially prepared room with proper acoustic and lighting treatment can range from \$50,000 to over \$100,000. Finally, it seems that running such a facility requires the services of a specialist both in attendance during conferences and also for coordination and problem solving in-between conferences. This can easily require between 1/2 and 1 person full time. Many collaborators are affiliated with organizations that don't have and can't easily provide such resources.

## **SOME FUTURE PLANS**

The video pilot project will continue and be expanded. The first expansion has already been implemented with the addition of a second video switch. Links to Japan and Italy have and are being pursued. The possibility of video conferencing at 120Cheaps makes it possible to eliminate dedicated links in favor of dial-up services, reducing link costs dramatically. Also, use of 128Cheaps is compatible with Basic Rate ISDN which is being deployed throughout the world and is, in the U.S., attractively priced.

High quality audio can and has been achieved using digital phone bit rates combined with the proper microphone and room arrangements. Rapid image transfer can be achieved using bit rates similar to those for digitized voice combined with such site equipment as pre-connected high speed FAX, electronic blackboards, and the like. It should be noted that conferencing systems based upon good audio and rapid imaging have been used quite successfully by organizations such as AT&T-Bell Laboratories for some time.

Audio conferencing of the type described above can be established for a few thousand dollars per end and doesn't seem to need the care and feeding required of video. Moreover, a upward migration path from audio to video appears possible. Consequently, audio conferencing that is both interoperable and upward compatible with video conferencing will be sought as part of further work in this area.